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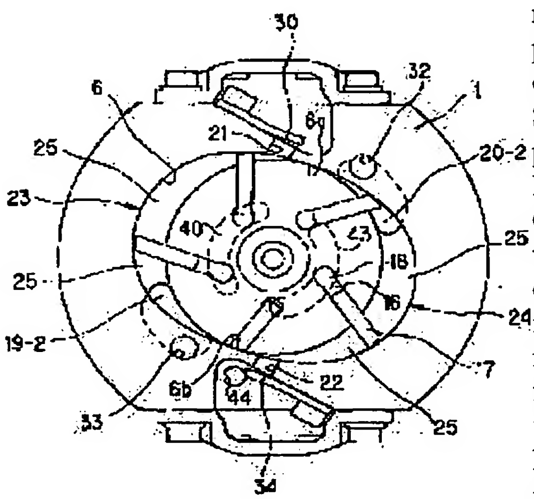
(71)Applicant : **SEIKO SEIKI CO LTD**
(72)Inventor : **YODA SEIICHIRO**

(54) GAS COMPRESSOR



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a vane rotary type gas compressor implementing high pressure difference required for a CO2 refrigeration cycle.
SOLUTION: A low pressure intake compressing portion 23 takes therein low pressure CO2 gas from low pressure intake ports 19, 19-2, compresses the CO2 gas to be intermediate pressure, and discharges the compressed CO2 gas to an intermediate pressure discharge port 21. A high pressure compression intake compressing portion 24 takes therein the intermediate pressure CO2 gas which is discharged from the intermediate pressure discharge port 21, from intermediate pressure intake ports 20, 20-2. The high pressure compression intake compressing portion compresses the intermediate pressure CO2 to be high pressure, and discharges the high pressure gas to a high pressure discharge port 22. Intermediate pressure CO2 gas is replenished with CO2 gas from an external refrigerant gas supply port 28 to make up for shortage of capacity by two state compression.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the suitable gas compressor for refrigerating cycle equipments, such as a car air-conditioner which uses a carbon dioxide (CO2) etc. as a refrigerant, an air conditioner, and heat pump.
[0002]
[Description of the Prior Art] In order to prevent contamination of earth environment, division, destruction of an ozone layer, and global warming in recent years, researches and developments of the refrigerating cycle equipment which uses a carbon dioxide with little [far] effect (CO2) as a refrigerant from chlorofluocarbon are furthered as a refrigerant used for a car air-conditioner etc.
[0003] As compared with the refrigerating cycle which uses conventional R-22, R-134a, etc. as a refrigerant in the refrigerating cycle which uses a carbon dioxide as a refrigerant, a pressure field is very high, and differential pressure is very large, although low voltage is served as to 3.5-4.0Pa, high pressure serves as 9.0-15MPa and just a compression ratio is small. The piston compressor is the most effective in order to realize big differential pressure efficiently generally, and the researches and developments about the piston compressor for carbon-dioxide refrigerants are prosperous in it.
[0004] Research and development in the refrigerating cycle which used the two-step compressor is also done by making to reduce high pressure on the other hand, without spoiling refrigerating capacity into a key objective.
[0005] The steamy compression equation refrigerating cycle of the two-step compression which used CO2, ethylene, ethane, nitrogen oxide, etc. as the refrigerant is indicated by JP,10-288411,A. The outline of this steamy compression equation refrigerating cycle is explained with reference to drawing 8 and drawing 9 .
[0006] With a radiator 200, heat is radiated, the high-pressure refrigerant gas (A of drawing 9) which the compressor 100 of two-step compression mold compressed the refrigerant gas, and compressed by the 2nd step of compression of this compressor 100 is cooled, and the refrigerant gas (B of drawing 9) which passed the radiator 200 is branched to two. A refrigerant is decompressed and injected with a decompression device 300, and a pressure falls, it serves as a vapor-liquid two phase (C of drawing 9), and while branching is led to one heat exchange path 400a of a condensator (heat exchanger) 400. The refrigerant of branched another side is led to heat exchange path 400b of another side of a condensator 400.
[0007] When the liquid phase changes to a gaseous phase, endoergic [of the refrigerant of the vapor-liquid two phase which passes heat exchange path 400a] is carried out from the refrigerant which passes heat exchange path 400b of another side (D of drawing 9), and it is returned to on the way [of the inhalation pressing operation of a compressor 100] (the 2nd step inhalation hole of a compressor 100). The part temperature falls (E of drawing 9), and heat exchange path 400b of another side is decompressed with another decompression device (expansion valve) 500 (F of drawing 9), carries out endoergic from the outside with the following evaporator (heat sink) 600 (G of drawing 9), and returns to the 1st step inhalation hole of a compressor 100 through an accumulator 700.

[0008] A diaphragm of both the decompression devices 400,700 is controlled for branched allocation of a refrigerant and a branched flow rate, and this adjusts the refrigerating capacity of a cycle, and a coefficient of performance to a fitness value.
[0009] In the 2nd step inhalation hole of the above-mentioned compressor 100, the refrigerant (H of drawing 9) compressed in the 1st step of a compressor 100 and the refrigerant which returns from heat exchange path 400a of a condensator 400 are mixed, and temperature becomes both midpoint (J of drawing 9). Generally, in the compression stroke of a compressor, temperature also rises with a pressure, the inclination in drawing 9 becomes so large that a compression start point (G, J) is in the left of drawing, the point (H, A) ending [part compression] moves to a left, and its temperature rise decreases. Since compression [the 2nd step of] start point of a compressor 100 is J point with temperature lower than H points, the work of compression of a compressor 100 is small, a coefficient of performance improves, and the temperature rise of a compressor 100 is also suppressed. The amount of endoergic in an evaporator 600 becomes large with F-G.
[0010] As a compressor 100 of the above-mentioned two-step compression mold, the scroll type compressor (refer to JP,63-243481,A) which raised a cam-plate mold piston compressor (refer to JP,61-79947,A) and the seal engine performance is adopted.
[0011] The vane rotary mold other than the above-mentioned piston mold and a scroll type is known by the gas compressor. A vane rotary mold gas compressor has the description of simplicity [structure], small, and low cost compared with a piston mold. However, it is unsuitable for having to seal a vane rotary mold in the line contact section at the tip of a vane to the piston mold sealing compression space all over the periphery of a piston, and producing big differential pressure.
[0012] When a vane rotary mold gas compressor is used for the refrigerating cycle which uses a carbon dioxide as a refrigerant and measures which the remarkable decline in volumetric efficiency by the gas leakage from compression space and the lack of seal is expected, and lessen leakage as much as possible are taken, power unrelated to compression will increase, or enlargement of a compressor and the increase of weight will be caused, and it becomes impossible to employ the description of vane rotary mold original efficiently.
[0013]
[Problem(s) to be Solved by the Invention] This invention offers conventionally the gas compressor which can realize high differential pressure with ordinary volumetric efficiency, solving an above-mentioned trouble and employing efficiently the easy structure of a vane rotary mold gas compressor, and the original description of being small.
[0014]
[Means for Solving the Problem] In order to solve an above-mentioned technical problem, it sets to the gas compressor of this invention. The cylinder room of a cross-section non-round shape, and Rota which is constructed horizontally across the above-mentioned cylinder interior of a room free [rotation] with a rotor shaft, and approaches two or more minor-axis sections of a cylinder indoor peripheral surface with predetermined spacing, Two or more vanes pressed by attitude ease and the cylinder indoor peripheral surface in the vane slot formed in above-mentioned Rota, The discharge opening arranged the inhalation hole arranged near [one] the minor-axis section of two or more above-mentioned minor-axis sections, and near [its / next] the minor-axis section, It is formed between the cylinder room applied to a discharge opening from the above-mentioned inhalation hole, and Rota. It has two or more inhalation compression zones which pass while the compression space isolation generation is carried out [compression space] by Rota rotated in the cylinder interior of a room and the vane changes the volume. In the gas compressor which inhales a refrigerant gas from an inhalation hole, and compression space compresses and carries out the regurgitation

to a discharge opening in an inhalation compression zone The low voltage inhalation compression zone which two or more above-mentioned inhalation compression zones inhale a low-pressure refrigerant gas from a low voltage inhalation hole, compress into the refrigerant gas of intermediate pressure, and carries out the regurgitation to an intermediate pressure discharge opening, It has the high-pressure compression inhalation compression zone which inhales the refrigerant gas supplied from the refrigerant gas and the outside of the above-mentioned intermediate pressure from an intermediate pressure inhalation hole, compresses into a high-pressure refrigerant gas, and carries out the regurgitation to a high-pressure discharge opening. The refrigerant gas supplied is supplied to an intermediate pressure inhalation hole via external refrigerant gas supply opening from the above-mentioned outside.

[0015] It is not necessary to change the volume of the compression space which operates by the low voltage inhalation compression zone, and the compression space which operates by the high-pressure compression inhalation compression zone, and becomes the structure of an easy and small cylinder room as usual, Rota, and a vane by supplying the part whose volume of a refrigerant gas was compressed into intermediate pressure by the low voltage inhalation compression zone, and decreased with a refrigerant gas from the exterior to a high-pressure compression inhalation compression zone. Mutually, the cylinder room of the cross-section ellipse form of a symmetry form, then its configuration are manufactured from the former, and the dimension configuration of the inhalation compression zone of a pair may be the same as what is circulating, and more specifically tends to put a cylinder room in practical use.

[0016] In this gas compressor, moreover, the refrigerant gas of the intermediate pressure breathed out to an intermediate pressure discharge opening The high-pressure refrigerant gas which is supplied to an intermediate pressure inhalation hole once it holds in an intermediate pressure regurgitation room, and is breathed out to a high-pressure discharge opening Once it holds in a high-pressure regurgitation room, it is sent to a delivery. An intermediate pressure oil reservoir room and a high-pressure oil reservoir room are established in the above-mentioned intermediate pressure regurgitation room and a high-pressure regurgitation room, respectively. If it is made for a back pressure room for the lubricating oil of the above-mentioned intermediate pressure oil reservoir room to press a vane while passing a low voltage inhalation compression zone to be supplied at a back pressure room for the lubricating oil of a high-pressure oil reservoir room to press a vane while passing a high-pressure compression inhalation compression zone The thrust to a cylinder room becomes strong moderately according to a compression pressure about a vane, and seal with compression space and the next compression space is improved by comparatively little power loss.

[0017] in addition, in this invention, it has "two or more minor-axis sections" -- "-- the inhalation compression zone for those intermediate pressure is prepared between a low voltage inhalation compression zone and a high-pressure compression inhalation compression zone, or the refrigerant gas of the intermediate pressure from two low voltage inhalation compression zones and these two low voltage inhalation compression zones is doubled, and it is made to send to the cylinder room of cross-section un-circular" in this case to a high-pressure compression inhalation compression zone including the cylinder room of for example, the conclusion form

[0018] Although the gas compressor of this invention is applicable also to the refrigerating cycle which carries out heat exchange of the refrigerant gas returned to the 2nd step of above-mentioned compression through a condensator 400, it does not necessarily need to let a condensator pass.

[0019]
[Embodiment of the Invention] The gestalt of implementation of this invention is hereafter explained with reference to drawing 1 - drawing 7 .
[0020] The II-II line sectional view of drawing 1 and drawing 3 of drawing of longitudinal section in which drawing 1 shows the gestalt of 1 implementation of this invention, and drawing 2 are block diagrams in which the III-III line sectional view, drawing 4 , drawing 5 , and drawing 6 of drawing 1 show A **** Fig. of the rear side block of the gas compressor of drawing 1 , a frontside block, and a front head, and drawing 7 shows the two-step compression stroke of the gas compressor of drawing 1 , respectively.
[0021] For a cylinder block and 2, as for a frontside block and 4, in drawing 1 , a rear side block and 3 are [1 / a front head and 5] casing.
[0022] As a cylinder block 1 is closed by the rear side block 2 and the frontside block 3 and shows a both-ends side to drawing 2 , the cylinder room 6 of a cross-section ellipse form is mostly formed in the interior. The outside end face of the above-mentioned rear side block 2 is closed by the above-mentioned casing 5, and the high-pressure regurgitation room 7 is formed between the rear side block 2 and casing 5. Moreover, the outside end face of the frontside block 3 is closed by the above-mentioned front head 4, and the intermediate pressure regurgitation room 8 is formed between the frontside block 3 and the front head 4.
[0023] 9 is Rota, and this Rota 9 is constructed across horizontally free [rotation] in the above-mentioned cylinder room 6 with a rotor shaft 10, and is close to two or more minor-axis sections explained after the inner skin of the cylinder room 6 with predetermined spacing. The above-mentioned rotor shaft 10 is supported by the bearing 11 of the rear side block 2, and the bearing 12 of the frontside block 3, and a front-side is extended to the front head 4 side, it engages with the electromagnetic clutch 13 with which the front head 4 was equipped, the rotational motion force of the engine of an automobile is transmitted through a belt 14, a pulley 15, and an electromagnetic clutch 13, and it rotates Rota 9 in the cylinder room 6.
[0024] The detail of the [cylinder indoor section], next the cylinder room 6 interior is explained.
[0025] As shown in drawing 2 , five vane slots 16 are formed in Rota 9 at the radial leaned a little from the Rota core. Attitude ease and the vane 17 which ****s to the inner skin of the cylinder room 6 are inserted in these vane slots 16 in Mizouchi. Moreover, the two minor-axis sections 6a and 6b of the inner skin of the cross-section **** elliptical cylinder room 6 serve as a circular face of the Rota shaft center, and the outer-diameter section of Rota 9 is close with these minor-axis sections 6a and 6b and predetermined spacing.
[0026] The back pressure room 18 is established in the pars basilaris ossis occipitalis of the above-mentioned vane slot 16, and according to the angular position in the cylinder room 6, suitable back pressure is added to this back pressure room 18 at it so that it may explain to a detail later.
[0027] The inhalation holes 19 and 20, 19-2, and 20-2 are arranged near the above-mentioned minor-axis sections 6a and 6b and in the travelling direction in Rota 9 by both side blocks 2 and 3 (drawing 4 , R> drawing 5 5 reference). Moreover, discharge openings 21 and 22 are arranged in the opposite side of near the minor-axis sections 6a and 6b, the inhalation holes 19 and 20, 19-2, and 20-2 by the cylinder block 1. and from the inhalation hole 19 near [one] minor-axis section 6a (or 6b), and 19-2 (20 or 20-2) Between the cylinder room 6 applied to the discharge opening 22 (or 21) arranged near [the / next] minor-axis section 6b (or 6a), and Rota 9 Two or more inhalation compression zones 23 and 24 are formed, and while the compression space 25 isolation generation is carried out [the compression space] by Rota 9 rotated in the cylinder room 6 and 1 set of vanes 17 and 17 changes the volume to these inhalation compression zones 23 and 24, it passes.

[0028] The passage of the refrigerant of this gas compression inside of a plane is explained referring to [the two-step compression process of the passage of a refrigerant, and a refrigerant], next drawing 7 .
[0029] Drawing 1 , the inhalation opening 26 shown in drawing 3 , the delivery 27 shown in drawing 1 , and the external refrigerant gas supply opening 28 are carrying out opening to the gas compressor, and it connects with piping of a refrigeration system. For example, when using it for the refrigeration system shown in drawing 8 , the external refrigerant gas supply opening 28 is connected to piping which leads to heat exchange path 400a of a condensator 400 again at piping which leads a delivery 27 to a radiator 200 at piping which leads the inhalation opening 26 to an accumulator 700, respectively.
[0030] The inhalation opening 26 connected to the low-tension side of a refrigeration system is open for free passage to the above-mentioned inhalation hole 19 through the inhalation opening free passage way 29 and the free passage hole 31 of the frontside block 3, this inhalation hole 19 is the low voltage inhalation hole which inhales a low voltage refrigerant gas, and the inhalation compression zone 23 with the low voltage inhalation hole 19 has become in it with the low voltage inhalation compression zone which inhales and compresses a low voltage refrigerant gas. In addition, the low voltage inhalation hole 19-2 by the side of the rear side block 2 is also open for free passage with the cylinder block low voltage free passage way 33 penetrated to the cylinder block 1 with the low voltage inhalation hole 19 by the side of the frontside block 3. The delivery 27 connected to the high-tension side of a refrigeration system is open for free passage in the above-mentioned high-pressure regurgitation room 7. The external refrigerant gas supply opening 28 connected to the intermediate pressure side of a refrigeration system is open for free passage in the above-mentioned intermediate pressure regurgitation room 8.
[0031] The discharge opening 21 of the low voltage inhalation compression zone 23 is the intermediate pressure discharge opening which carries out the regurgitation of the refrigerant gas compressed into intermediate pressure, and is open for free passage in the above-mentioned intermediate pressure regurgitation room 8 through a discharge valve 30 and the free passage way 47. In addition, the above-mentioned discharge valve 30 is a well-known discharge valve conventionally which consists of a little thick valve guide which stops and backs up the valve seat formed on the outskirts of discharge opening 21 of a cylinder block 1, a lead valve, and the excessive knee of this lead valve.
[0032] The inhalation hole 20 of another inhalation compression zone 24 is also open for free passage in the intermediate pressure regurgitation room 8, and the intermediate pressure inhalation hole with which this inhalation hole 20 inhales middle pressure refrigerant gas, and the inhalation compression zone 24 are the high-pressure compression inhalation compression zone which compresses a refrigerant gas into high pressure from intermediate pressure.
[0033] In addition, the above-mentioned inhalation hole 19 of the frontside block 2, the above-mentioned inhalation hole 19-2 of the rear side block 2, and the intermediate pressure inhalation hole 20-2 serve as a hollow established in the end face which faces the cylinder room 6 of both side blocks 2 and 3, respectively, and it penetrates and they are opening the above-mentioned inhalation hole 20 of the frontside block 2 for free passage with the intermediate pressure regurgitation room 8.
[0034] The intermediate pressure inhalation hole 20 by the side of the rear side block 2 is open for free passage with the cylinder block intermediate pressure free passage way 32 penetrated to the cylinder block 1 with the intermediate pressure inhalation hole 20 by the side of the frontside block 3.
[0035] The high-pressure discharge opening 22 of the high-pressure compression inhalation

compression zone 24 is open for free passage with the high-pressure regurgitation room 7 through a discharge valve 34 (refer to drawing 2), the high-pressure refrigerant paths 44, 45, and 46 (refer to drawing 4), and an oil separator 35 (refer to drawing 1). In addition, the above-mentioned discharge valve 34 is a well-known discharge valve conventionally which consists of a little thick valve guide which stops and backs up the valve seat formed on the outskirts of discharge opening 22 of a cylinder block 1 like the discharge valve 30, a lead valve, and the excessive knee of this lead valve.

[0036] Refrigerant inhalation / compression actuation of a gas compressor is as follows.

[0037] By rotation of Rota 9 of a gas compressor, the compression space 25 located in the low voltage inhalation compression zone 23 is followed on rotation of Rota 9, and they are the low voltage inhalation hole 19 and CO2 of 19-2 to about 3.5 MPa(s) at a volume increasing process. A refrigerant gas is inhaled, this is compressed into intermediate pressure in a volume decrease process, and it sends into the intermediate pressure regurgitation room 8 through a discharge valve 30 from the intermediate pressure discharge opening 21. The refrigerant of intermediate pressure is sent into this intermediate pressure regurgitation room 8 from the external refrigerant feed hopper 28, and when compressing into 10MPa(s) from 3.5MPa, it is controlled by the decompression device of a refrigeration system so that intermediate pressure is mostly set to that middle 6.5-7MPa.

[0038] In the meantime, in the compression space 25 located in the high-pressure compression inhalation compression zone 24, the refrigerant gas of about 6.5 MPa(s) of the intermediate pressure regurgitation room 8 is inhaled from the intermediate pressure inhalation hole 20 and 20-2 by the volume increasing process, this is compressed into the high pressure of about 10 MPa(s) in a volume decrease process, and it sends into the high-pressure regurgitation room 7 through a discharge valve 34 and an oil separator 35 from the high-pressure discharge opening 22. The high-pressure refrigerant of about 10 MPa(s) of the high-pressure regurgitation room 7 is sent out from a delivery 27 outside.

[0039] Thus, compression of high differential pressure, such as 3.5MPa to 10MPa(s), is realizable with two steps of compression, the 1st-step compression of the low voltage inhalation compression zone 23 and compression of the 2nd step of the high-pressure compression inhalation compression zone 24. An intermediate pressure is automatically adjusted by the flow rate of the refrigerant gas which flows from the external refrigerant gas supply opening 28, and the volume of the compression space of the 1st step and the 2nd step can be made the same.

[0040] A vane 17 is pressed by the cylinder indoor peripheral surface in the [back pressure and lubrication] above-mentioned gas compressor. In addition to the centrifugal force by rotation of the vane itself, this thrust is based on the back pressure which joins the back pressure room 18. As for this back pressure, in the low voltage inhalation compression zone 23, considering as mist or low voltage is more desirable than the high-pressure compression inhalation compression zone 24. Because, although the seal of a vane and a cylinder room will become good in the low voltage inhalation compression zone 23 if not much high back pressure is applied to the pressure to compress overcoming a pressure of this level, and pressing a vane 17 to a cylinder indoor peripheral surface like 6.5MPa(s) It is because back pressure higher [the pressure compressed by the high-pressure compression inhalation compression zone 24 to power loss becoming large too much is as high as / like 10MPa(s) /, and] in order to overcome this high pressure and to press a vane 17 to a cylinder indoor peripheral surface is required.

[0041] So, in this invention, the high-pressure oil reservoir room 37 is established in the pars basilaris ossis occipitalis of the intermediate pressure regurgitation room 8 at the pars basilaris ossis occipitalis of the intermediate pressure oil reservoir room 36 and the high-

pressure regurgitation room 7. The back pressure room 18 for the lubricating oil of the high-pressure oil reservoir room 37 to press the vane 17 while passing the high-pressure compression inhalation compression zone 24 is supplied at the back pressure room 18 for the lubricating oil of the intermediate pressure oil reservoir room 36 to press the vane 17 while passing the low voltage inhalation compression zone 23.

[0042] That is, the lubricating oil of the intermediate pressure oil reservoir room 36 carries out the lubrication of the bearing, it is further decompressed with the front diaphragm hole 39, is sent [it is sent to bearing 12 from the front oil gallery 38, and] to the middle back pressure oil supply crevice 40 of both side blocks 2 and 3, and is supplied to the back pressure room 18 under low voltage inhalation compression zone 23 passage which touches this middle back pressure oil supply crevice 40. On the other hand, the lubricating oil of the high-pressure oil reservoir room 37 carries out the lubrication of the bearing, it is further decompressed with the rear diaphragm hole 42, is sent [it is sent to bearing 11 from the rear oil gallery 41, and] to the high back pressure oil supply crevice 43 of both side blocks 2 and 3, and is supplied to the back pressure room 18 under high-pressure compression inhalation compression zone 24 passage which touches this middle back pressure oil supply crevice 43. In addition, the supply way of the middle back pressure oil to the middle back pressure oil supply crevice 40 of the rear side block 2 and the supply way of the high back pressure oil to the high back pressure oil supply crevice 43 of the frontside block 3 omit illustration.

[0043] The pressure of the middle back pressure oil supply crevice 40 is lower than the pressure of the high back pressure oil supply crevice 43, the back pressure to which the vane while passing the low voltage inhalation compression zone 23, and the vane while passing the high-pressure compression inhalation compression zone 24 suited each is applied, and the seal of a good vane and a cylinder room is secured without excessive power loss.

[0044] In addition, the lubricating oil which begins to leak from the back pressure room 17 is used also for the lubrication of the sliding surface of Rota 9 and a vane 17, and the sliding surface of a vane 17 and the cylinder room 6. Moreover, the lubricating oil of the intermediate pressure oil reservoir room 36 and the high-pressure oil reservoir room 37 is sent also to Rota 9 and the slide contact side of a vane 17 and both side blocks 2 and 3 through the path of an illustration abbreviation, and is used also for the lubrication. It is separated from a refrigerant by the above-mentioned oil separator 35, and a lubricating oil is returned to the high-pressure oil reservoir room 37. Recovery of the lubricating oil to the intermediate pressure oil reservoir room 36 is based on separation recovery from the refrigerant once held in the intermediate pressure regurgitation room 8.

[0045]

[Effect of the Invention] As explained to the detail above, the gas compressor of this invention While two or more compression space of the equal volume carries out sequential passage of a low voltage inhalation compression zone and the high-pressure compression inhalation compression zone mutually, in a low voltage inhalation compression zone A low-pressure refrigerant gas is inhaled from a low voltage inhalation hole, and it compresses into the refrigerant gas of intermediate pressure. To an intermediate pressure discharge opening in discharge and a high-pressure compression inhalation compression zone Since the refrigerant gas for a supplement supplied from the above-mentioned refrigerant gas and the above-mentioned outside of intermediate pressure is inhaled from an intermediate pressure inhalation hole, it compresses into a high-pressure refrigerant gas and it was made to carry out the regurgitation to a high-pressure discharge opening The same Rota as the vane rotary mold gas compressor using the conventional refrigerants, such as chlorofluocarbon, the vane, and the cylinder could be used, and it could be easy, and could consider as low cost and a small gas compressor, and the gas compressor of the high differential pressure which used a

carbon dioxide, ethylene, ethane, nitrogen oxide, etc. as the refrigerant has been realized.

CLAIMS

[Claim(s)]
[Claim 1] The cylinder room of a cross-section non-round shape, and Rota which is constructed horizontally across the above-mentioned cylinder interior of a room free [rotation] with a rotor shaft, and approaches two or more minor-axis sections of a cylinder indoor peripheral surface with predetermined spacing, Two or more vanes pressed by attitude ease and the cylinder indoor peripheral surface in the vane slot formed in above-mentioned Rota, The discharge opening arranged the inhalation hole arranged near [one] the minor-axis section of two or more above-mentioned minor-axis sections, and near [its / next] the minor-axis section, It is formed between the cylinder room applied to a discharge opening from the above-mentioned inhalation hole, and Rota. It has two or more inhalation compression zones which pass while the compression space isolation generation is carried out [compression space] by Rota rotated in the cylinder interior of a room and the vane changes the volume. In the gas compressor which inhales a refrigerant gas from an inhalation hole, and compression space compresses and carries out the regurgitation to a discharge opening in an inhalation compression zone The low voltage inhalation compression zone which two or more above-mentioned inhalation compression zones inhale a low-pressure refrigerant gas from a low voltage inhalation hole, compress into the refrigerant gas of intermediate pressure, and carries out the regurgitation to an intermediate pressure discharge opening, It has the high-pressure compression inhalation compression zone which inhales the refrigerant gas supplied from the refrigerant gas and the outside of the above-mentioned intermediate pressure from an intermediate pressure inhalation hole, compresses into a high-pressure refrigerant gas, and carries out the regurgitation to a high-pressure discharge opening. It is the gas compressor characterized by supplying the refrigerant gas supplied to an intermediate pressure inhalation hole via external refrigerant gas supply opening from the above-mentioned outside.
[Claim 2] The refrigerant gas of the intermediate pressure breathed out to an intermediate pressure discharge opening The high-pressure refrigerant gas which is supplied to an intermediate pressure inhalation hole once it holds in an intermediate pressure regurgitation room, and is breathed out to a high-pressure discharge opening Once it holds in a high-pressure regurgitation room, it is sent to a delivery. An intermediate pressure oil reservoir room and a high-pressure oil reservoir room are established in the above-mentioned intermediate pressure regurgitation room and a high-pressure regurgitation room, respectively. The gas compressor according to claim 1 characterized by supplying a back pressure room for the lubricating oil of the above-mentioned intermediate pressure oil reservoir room

pressing a vane while passing a low voltage inhalation compression zone at a back pressure room for the lubricating oil of a high-pressure oil reservoir room pressing a vane while passing a high-pressure compression inhalation compression zone.
[Claim 3] The gas compressor according to claim 1 whose cross-section non-round shape is an ellipse form.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing of longitudinal section showing the gestalt of 1 implementation of this invention.
[Drawing 2] The II-II line sectional view of drawing 1 .
[Drawing 3] The III-III line sectional view of drawing 1 .
[Drawing 4] A **** Fig. of a rear side block of drawing 1 .
[Drawing 5] A **** Fig. of a frontside block of drawing 1 .
[Drawing 6] A **** Fig. of the front head of drawing 1 .
[Drawing 7] The explanatory view of the steamy compression equation refrigerating cycle of the method which returns a refrigerant to a two-step pressing operation.
[Drawing 8] The block diagram showing the two-step compression stroke of the gas compressor of drawing 1 .
[Drawing 9] The Mollier chart of the steamy compression equation refrigerating cycle of drawing 6 .
[Description of Notations]
6 Cylinder Room
6a Minor-axis section
6b Minor-axis section
7 High-Pressure Regurgitation Room
8 Intermediate Pressure Regurgitation Room
9 Rota
10 Rotor Shaft
16 Vane Slot
17 Vane
18 Back Pressure Room
19 Low Voltage Inhalation Hole
19-2 Low Voltage Inhalation Hole
20 Intermediate Pressure Inhalation Hole
20-2 Intermediate Pressure Inhalation Hole

21 Intermediate Pressure Discharge Opening
22 High-Pressure Discharge Opening
23 Low Voltage Inhalation Compression Zone
24 High-Pressure Compression Inhalation Compression Zone
25 Compression Space
26 Inhalation Opening
27 Delivery
28 External Refrigerant Gas Supply Opening
36 Intermediate Pressure Oil Reservoir Room
37 High-Pressure Oil Reservoir Room
100 Compressor
200 Radiator
400 Condensator
600 Evaporator

[Translation done.]

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	３６１	３６１Ｇ	
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(71)出願人 000107996
セイコー精機株式会社
千葉県習志野市屋敷４丁目３番１号

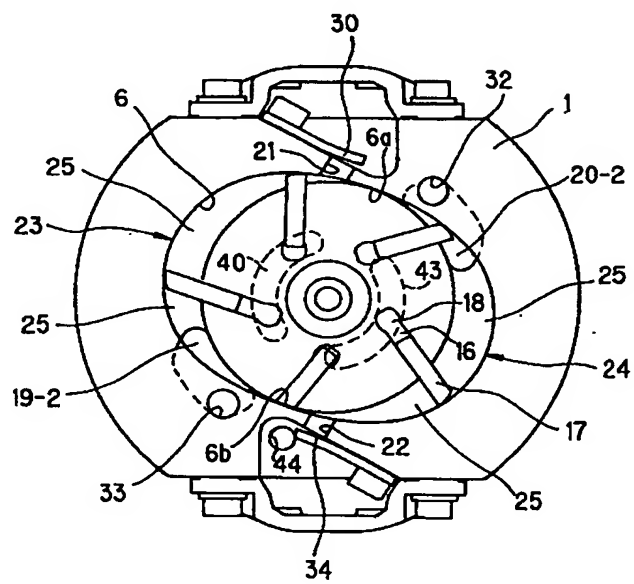
(72)発明者 依田 誠一郎
千葉県習志野市屋敷４丁目３番１号 セイコー精機株式会社内

(74)代理人 100069431
弁理士 和田 成則

最終頁に続く

(54)【発明の名称】 気体圧縮機

(57)【要約】
【課題】 CO_2 冷凍サイクルに必要な高い圧力差を実現できるベーンロータリ型気体圧縮機を提供する。
【解決手段】 低圧吸入圧縮部２３は、低圧吸入孔１９、１９－２から低圧 CO_2 ガスを吸入して中間圧に圧縮し、中間圧吐出孔２１に吐出する。高圧圧縮吸入圧縮部２４は、中間圧吐出孔２１から吐出した中間圧 CO_2 ガスを中間圧吸入孔２０、２０－２から吸入して高圧に圧縮し、高圧吐出孔２２に吐出する。中間圧 CO_2 ガスには外部冷媒ガス供給口２８から CO_2 ガスを補充し、２段圧縮による容量不足を補う。



【特許請求の範囲】

【請求項１】　断面非円形のシリンダ室と、上記シリンダ室内にロータ軸により回転自在に横架され、シリンダ室内周面の複数の短径部に所定の間隔をもって近接するロータと、上記ロータに形成されたベーン溝に進退自在、かつ、シリンダ室内周面に押圧される複数のベーンと、上記複数の短径部のうちのひとつの短径部付近に配設された吸入孔およびその隣の短径部付近に配設された吐出孔と、上記吸入孔から吐出孔にかけてのシリンダ室とロータとの間に形成され、シリンダ室内で回転するロータとベーンにより隔離生成される圧縮室がその体積を変化させながら通過する複数の吸入圧縮部とを有し、吸入圧縮部において圧縮室が吸入孔から冷媒ガスを吸入し、圧縮して吐出孔に吐出する気体圧縮機において、上記複数の吸入圧縮部が、

低圧の冷媒ガスを低圧吸入孔から吸入して中間圧の冷媒ガスに圧縮して中間圧吐出孔へ吐出する低圧吸入圧縮部と、

上記中間圧の冷媒ガスおよび外部から供給される冷媒ガスを中間圧吸入孔から吸入して高圧の冷媒ガスに圧縮して高圧吐出孔へ吐出する高圧圧縮吸入圧縮部とを有し、

上記外部から供給される冷媒ガスは、外部冷媒ガス供給口を経由して中間圧吸入孔へ供給されるようになっていることを特徴とする気体圧縮機。

【請求項２】　中間圧吐出孔へ吐出される中間圧の冷媒ガスは、中間圧吐出室に一旦収容されてから中間圧吸入孔へ供給され、

高圧吐出孔へ吐出される高圧の冷媒ガスは、高圧吐出室に一旦収容されてから吐出口へ送られるようになっており、

上記中間圧吐出室および高圧吐出室にはそれぞれ中間圧油貯留室および高圧油貯留室が設けられ、

上記中間圧油貯留室の潤滑油が低圧吸入圧縮部を通過中のベーンを押圧するための背圧室へ、高圧油貯留室の潤滑油が高圧圧縮吸入圧縮部を通過中のベーンを押圧するための背圧室へ供給されるようになっていることを特徴とする請求項１記載の気体圧縮機。

【請求項３】　断面非円形が楕円形である請求項１記載の気体圧縮機。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、二酸化炭素（CO_2）等を冷媒として使用するカーエアコン、空調装置、ヒートポンプ等の冷凍サイクル装置に好適な気体圧縮機に関する。

【０００２】

【従来の技術】近年、地球環境の汚染、とりわけ、オゾン層の破壊、地球温暖化を防止するために、カーエアコン等に使用する冷媒として、フロンよりはるかに影響の少ない二酸化炭素（CO_2）を冷媒とする冷凍サイクル

装置の研究開発が進められている。

【０００３】二酸化炭素を冷媒とする冷凍サイクルでは、従来のＲ－２２やＲ－１３４ａ等を冷媒とする冷凍サイクルと比較して圧力領域が非常に高く、低圧は３．５～４．０Ｐａ、高圧は９．０～１５ＭＰａとなり、圧縮比こそ小さいものの圧力差が非常に大きい。ピストン圧縮機は、一般に大きな圧力差を効率よく実現するために最も有効であり、二酸化炭素冷媒用のピストン圧縮機に関する研究開発が盛んである。

【０００４】一方、冷凍能力を損なわずに高圧を低下させることを主目的として、２段圧縮機を使用した冷凍サイクルも研究開発されている。

【０００５】特開平１０－２８８４１１号公報には、CO_2、エチレン、エタン、酸化窒素等を冷媒とした２段圧縮の蒸気圧縮式冷凍サイクルが開示されている。この蒸気圧縮式冷凍サイクルの概要を図８および図９を参照して説明する。

【０００６】２段圧縮型の圧縮機１００が冷媒ガスを圧縮し、この圧縮機１００の２段目の圧縮により圧縮した高圧冷媒ガス（図９のＡ）を放熱器２００で放熱して冷却し、放熱器２００を通過した冷媒ガス（図９のＢ）をふたつに分岐する。分岐した一方の冷媒は、減圧装置３００で減圧して噴射され、圧力が下がって気液二相となり（図９のＣ）、冷却器（熱交換器）４００の一方の熱交換通路４００ａへ導かれる。分岐した他方の冷媒は、冷却器４００の他方の熱交換通路４００ｂへ導かれる。

【０００７】熱交換通路４００ａを通過する気液二相の冷媒は、液相が気相に変化することにより、他方の熱交換通路４００ｂを通過する冷媒から吸熱し（図９のＤ）、圧縮機１００の吸入圧縮工程の途中（圧縮機１００の２段目吸入孔）に戻される。他方の熱交換通路４００ｂはその分温度が下がって（図９のＥ）、別の減圧装置（膨張弁）５００で減圧し（図９のＦ）、次の蒸発器（吸熱器）６００で外部から吸熱して（図９のＧ）、アキュムレータ７００を介して圧縮機１００の１段目吸入孔に戻る。

【０００８】分岐される冷媒の配分や流量を、両減圧装置４００、７００の絞りを制御し、これによりサイクルの冷凍能力、成績係数を適性値に調節する。

【０００９】上記の圧縮機１００の２段目吸入孔では、圧縮機１００の１段目で圧縮された冷媒（図９のＨ）と冷却器４００の熱交換通路４００ａから戻ってくる冷媒とが混合され、温度が両者の中間点（図９のＪ）になる。一般に圧縮機の圧縮行程では、圧力とともに温度も上昇し、図９におけるその勾配は、圧縮開始点（Ｇ、Ｊ）が図の左方にある程大きくなり、その分圧縮終了点（Ｈ、Ａ）は左方へ移動して、温度上昇が少なくなる。圧縮機１００の２段目の圧縮開始点は、Ｈ点より温度の低いＪ点であるから、圧縮機１００の圧縮仕事は小さく、成績係数が向上し、圧縮機１００の温度上昇も抑え

られる。蒸発器６００での吸熱量はＦ－Ｇと大きくなる。

【００１０】上記の２段圧縮型の圧縮機１００としては、斜板型ピストン圧縮機（特開昭６１－７９９４７号公報参照）やシール性能を向上させたスクロール型圧縮機（特開昭６３－２４３４８１号公報参照）が採用されている。

【００１１】気体圧縮機には、上記のピストン型、スクロール型の他に、ベーンロータリ型が知られている。ベーンロータリ型気体圧縮機は、ピストン型に比べて構造が簡単、小型、低コストという特徴を有する。しかし、ピストン型がピストンの外周全面で圧縮室の密封を行っているのに対し、ベーンロータリ型は、ベーン先端の線接触部で密封しなければならず、大きな圧力差を生じさせるには不向きである。

【００１２】二酸化炭素を冷媒とする冷凍サイクルにベーンロータリ型気体圧縮機を用いた場合、圧縮室からのガス漏れ、密封不足による著しい体積効率の低下が予想され、また、漏れを極力少なくするような対策をとると、圧縮とは無関係な動力が増えたり、圧縮機の大型化、重量増を招くことになり、ベーンロータリ型本来の特徴を生かすことができなくなる。

【００１３】

【発明が解決しようとする課題】この発明は、上述の問題点を解決し、ベーンロータリ型気体圧縮機の簡単な構造、小型という本来の特徴を生かしながら、従来並みの体積効率で高い圧力差を実現できる気体圧縮機を提供するものである。

【００１４】

【課題を解決するための手段】上述の課題を解決するために、この発明の気体圧縮機においては、断面非円形のシリンダ室と、上記シリンダ室内にロータ軸により回転自在に横架され、シリンダ室内周面の複数の短径部に所定の間隔をもって近接するロータと、上記ロータに形成されたベーン溝に進退自在、かつ、シリンダ室内周面に押圧される複数のベーンと、上記複数の短径部のうちのひとつの短径部付近に配設された吸入孔およびその隣の短径部付近に配設された吐出孔と、上記吸入孔から吐出孔にかけてのシリンダ室とロータとの間に形成され、シリンダ室内で回転するロータとベーンにより隔離生成される圧縮室がその体積を変化させながら通過する複数の吸入圧縮部とを有し、吸入圧縮部において圧縮室が吸入孔から冷媒ガスを吸入し、圧縮して吐出孔に吐出する気体圧縮機において、上記複数の吸入圧縮部が、低圧の冷媒ガスを低圧吸入孔から吸入して中間圧の冷媒ガスに圧縮して中間圧吐出孔へ吐出する低圧吸入圧縮部と、上記中間圧の冷媒ガスおよび外部から供給される冷媒ガスを中間圧吸入孔から吸入して高圧の冷媒ガスに圧縮して高圧吐出孔へ吐出する高圧圧縮吸入圧縮部とを有し、上記外部から供給される冷媒ガスは、外部冷媒ガス供給口を経由して中間圧吸入孔へ供給されるようになっている。

【００１５】低圧吸入圧縮部で中間圧に圧縮され冷媒ガスの体積が減った分を、高圧圧縮吸入圧縮部へ外部から冷媒ガスで補充することにより、低圧吸入圧縮部で作動する圧縮室と高圧圧縮吸入圧縮部で作動する圧縮室との体積を変える必要がなく、従来どおりの簡単で小型なシリンダ室、ロータ、ベーンの構造となる。より具体的には、例えば、シリンダ室を一対の吸入圧縮部の寸法形状が互いに対称形の断面楕円形のシリンダ室とすれば、その形状が従来から製造され、流通しているものと同じでよいことになり、実用化しやすいものになる。

【００１６】また、この気体圧縮機において、中間圧吐出孔へ吐出される中間圧の冷媒ガスは、中間圧吐出室に一旦収容されてから中間圧吸入孔へ供給され、高圧吐出孔へ吐出される高圧の冷媒ガスは、高圧吐出室に一旦収容されてから吐出口へ送られるようになっており、上記中間圧吐出室および高圧吐出室にはそれぞれ中間圧油貯留室および高圧油貯留室が設けられ、上記中間圧油貯留室の潤滑油が低圧吸入圧縮部を通過中のベーンを押圧するための背圧室へ、高圧油貯留室の潤滑油が高圧圧縮吸入圧縮部を通過中のベーンを押圧するための背圧室へ供給されるようにすると、ベーンをシリンダ室への押圧力が圧縮圧力に応じて適度に強まり、比較的少ない動力損で圧縮室と隣の圧縮室との密封が改善される。

【００１７】なお、この発明において、「複数の短径部」を有する「断面非円形」のシリンダ室には、例えば、おむすび形のシリンダ室を含み、この場合は、低圧吸入圧縮部と高圧圧縮吸入圧縮部との間に、その中間圧用の吸入圧縮部を設けたり、ふたつの低圧吸入圧縮部とこのふたつの低圧吸入圧縮部からの中間圧の冷媒ガスを合わせて高圧圧縮吸入圧縮部へ送るようにする。

【００１８】この発明の気体圧縮機は、上述の２段目の圧縮用に戻す冷媒ガスを冷却器４００を通して熱交換する冷凍サイクルにも適用できるが、必ずしも冷却器を通す必要はない。

【００１９】

【発明の実施の形態】この発明の実施の形態を、以下、図１～図７を参照して説明する。

【００２０】図１は、この発明の一実施の形態を示す縦断面図、図２は、図１のＩＩ－ＩＩ線断面図、図３は、図１のＩＩＩ－ＩＩＩ線断面図、図４、図５および図６は、それぞれ図１の気体圧縮機のリアサイドブロック、フロントサイドブロックおよびフロントヘッドのＡ矢示図、図７は、図１の気体圧縮機の２段圧縮行程を示すブロック図である。

【００２１】図１において、１はシリンダブロック、２はリアサイドブロック、３はフロントサイドブロック、４はフロントヘッド、５はケーシングである。

【００２２】シリンダブロック１は、両端面をリアサイドブロック２とフロントサイドブロック３によって塞が

れ、図２に示すように、内部にほぼ断面楕円形のシリンダ室６が形成されている。上記リアサイドブロック２の外側端面は上記ケーシング５により塞がれ、リアサイドブロック２とケーシング５との間には高圧吐出室７が形成されている。また、フロントサイドブロック３の外側端面は上記フロントヘッド４により塞がれ、フロントサイドブロック３とフロントヘッド４との間には中間圧吐出室８が形成されている。

【００２３】９はロータで、このロータ９は、ロータ軸１０により上記シリンダ室６内に回転自在に横架され、シリンダ室６の内周面の、後に説明する、複数の短径部に所定の間隔をもって近接している。上記ロータ軸１０は、リアサイドブロック２の軸受部１１とフロントサイドブロック３の軸受部１２により支持され、フロント側はフロントヘッド４側に伸びて、フロントヘッド４に装着された電磁クラッチ１３と係合し、ベルト１４、プーリ１５、電磁クラッチ１３を介して自動車のエンジンの回転動力が伝達され、シリンダ室６内でロータ９を回転するようになっている。

【００２４】［シリンダ室内部］次に、シリンダ室６内部の詳細を説明する。

【００２５】図２に示すように、ロータ９には５個のベーン溝１６がロータ中心からやや傾けた放射状に形成されている。これらのベーン溝１６には、溝内を進退自在、かつ、シリンダ室６の内周面に摺接するベーン１７が挿入されている。また、断面ほぼ楕円形状のシリンダ室６の内周面の２か所の短径部６ａ、６ｂはロータ軸中心の円弧面となっており、ロータ９の外径部がこれらの短径部６ａ、６ｂと所定の間隔をもって近接している。

【００２６】上記ベーン溝１６の底部には、背圧室１８が設けられ、この背圧室１８には、後に詳細に説明するように、シリンダ室６内の角度位置に応じて適当な背圧が付加されるようになっている。

【００２７】上記短径部６ａ、６ｂの付近、ロータ９の進行方向には、両サイドブロック２、３に吸入孔１９、２０、１９－２、２０－２が配設されている（図４、図５参照）。また、短径部６ａ、６ｂの付近、吸入孔１９、２０、１９－２、２０－２の反対側には、シリンダブロック１に吐出孔２１、２２が配設されている。そして、ひとつの短径部６ａ（または６ｂ）付近の吸入孔１９、１９－２（または２０、２０－２）から、その隣の短径部６ｂ（または６ａ）付近に配設された吐出孔２２（または２１）にかけてのシリンダ室６とロータ９との間には、複数の吸入圧縮部２３、２４が形成され、これらの吸入圧縮部２３、２４には、シリンダ室６内で回転するロータ９とひと組のベーン１７、１７により隔離生成される圧縮室２５がその体積を変化させながら通過するようになっている。

【００２８】［冷媒の流路と冷媒の２段圧縮過程］次に、図７を参照しながら、この気体圧縮機内の冷媒の流

路を説明する。

【００２９】気体圧縮機には、図１、図３に示した吸入口２６、図１に示した吐出口２７および外部冷媒ガス供給口２８が開口しており、冷凍システムの配管に接続されるようになっている。例えば、図８に示した冷凍システムに使用する場合は、吸入口２６をアキュムレータ７００に通じる配管に、吐出口２７を放熱器２００に通じる配管に、また、外部冷媒ガス供給口２８を冷却器４００の熱交換通路４００ａに通じる配管に、それぞれ接続する。

【００３０】冷凍システムの低圧側に接続される吸入口２６は、吸入口連通路２９、フロントサイドブロック３の連通孔３１を介して上記吸入孔１９に連通し、この吸入孔１９は、低圧冷媒ガスを吸入する低圧吸入孔となっており、低圧吸入孔１９のある吸入圧縮部２３は、低圧冷媒ガスを吸入して圧縮する低圧吸入圧縮部となっている。なお、リアサイドブロック２側の低圧吸入孔１９－２も、シリンダブロック１に貫通したシリンダブロック低圧連通路３３によりフロントサイドブロック３側の低圧吸入孔１９と連通している。冷凍システムの高圧側に接続される吐出口２７は、上記高圧吐出室７に連通している。冷凍システムの中間圧側に接続される外部冷媒ガス供給口２８は、上記中間圧吐出室８に連通している。

【００３１】低圧吸入圧縮部２３の吐出孔２１は、中間圧に圧縮した冷媒ガスを吐出する中間圧吐出孔となっていて、吐出弁３０、連通路４７を介して上記中間圧吐出室８に連通している。なお、上記吐出弁３０は、シリンダブロック１の吐出孔２１周辺に形成された弁座、リードバルブ、このリードバルブの過大な曲りを抑えてバックアップするやや肉厚のバルブガイド等からなる従来周知の吐出弁である。

【００３２】もう一方の吸入圧縮部２４の吸入孔２０もまた中間圧吐出室８に連通しており、この吸入孔２０は、中間圧冷媒ガスを吸入する中間圧吸入孔、吸入圧縮部２４は、中間圧から高圧に冷媒ガスを圧縮する高圧圧縮吸入圧縮部となっている。

【００３３】なお、フロントサイドブロック２の上記の吸入孔１９と、リアサイドブロック２の上記の吸入孔１９－２、中間圧吸入孔２０－２は、それぞれ両サイドブロック２、３のシリンダ室６に面する端面に設けられた凹所となっており、フロントサイドブロック２の上記の吸入孔２０は貫通して中間圧吐出室８と連通している。

【００３４】リアサイドブロック２側の中間圧吸入孔２０は、シリンダブロック１に貫通したシリンダブロック中間圧連通路３２によりフロントサイドブロック３側の中間圧吸入孔２０と連通している。

【００３５】高圧圧縮吸入圧縮部２４の高圧吐出孔２２は吐出弁３４（図２参照）、高圧冷媒通路４４、４５、４６（図４参照）および油分離器３５（図１参照）を介して高圧吐出室７と連通している。なお、上記吐出弁３

４は、吐出弁３０と同様にシリンダブロック１の吐出孔２２周辺に形成された弁座、リードバルブ、このリードバルブの過大な曲りを抑えてバックアップするやや肉厚のバルブガイド等からなる従来周知の吐出弁である。

【００３６】気体圧縮機の冷媒吸入・圧縮動作は以下のようになる。

【００３７】気体圧縮機のロータ９の回転により、低圧吸入圧縮部２３に位置する圧縮室２５は、ロータ９の回転に伴って、体積増加過程で低圧吸入孔１９、１９－２から約３．５ＭＰａのCO_2冷媒ガスを吸入し、体積減少過程でこれを中間圧に圧縮して中間圧吐出孔２１から吐出弁３０を介して中間圧吐出室８へ送り込む。この中間圧吐出室８には、外部冷媒供給口２８から中間圧の冷媒が送り込まれており、３．５ＭＰａから１０ＭＰａに圧縮する場合、中間圧がほぼその中間の６．５～７ＭＰａになるように冷凍システムの減圧装置で制御されている。

【００３８】この間、高圧圧縮吸入圧縮部２４に位置する圧縮室２５では、体積増加過程で中間圧吸入孔２０、２０－２から中間圧吐出室８の約６．５ＭＰａの冷媒ガスを吸入し、体積減少過程でこれを約１０ＭＰａの高圧に圧縮して高圧吐出孔２２から吐出弁３４、油分離器３５を介して高圧吐出室７へ送り込む。高圧吐出室７の約１０ＭＰａの高圧冷媒は、吐出口２７から外部へ送り出される。

【００３９】このように、低圧吸入圧縮部２３の第１段目の圧縮と、高圧圧縮吸入圧縮部２４の第２段目の圧縮の２段の圧縮により、例えば、３．５ＭＰａから１０ＭＰａというような、高い圧力差の圧縮を実現できる。外部冷媒ガス供給口２８から流入する冷媒ガスの流量により中間圧力は自動的に調整され、第１段目と第２段目の圧縮室の体積を同一とすることができる。

【００４０】［背圧と潤滑］上述の気体圧縮機では、ベーン１７はシリンダ室内周面に押圧される。この押圧力はベーン自体の回転による遠心力に加えて、背圧室１８に加わる背圧によっている。この背圧は、低圧吸入圧縮部２３では高圧圧縮吸入圧縮部２４よりもやや低圧とすることが望ましい。なぜならば、低圧吸入圧縮部２３では圧縮する圧力が６．５ＭＰａ程で、この程度の圧力に打ち勝ってベーン１７をシリンダ室内周面に押圧するのにあまり高い背圧を加えると、ベーンとシリンダ室とのシールは良好になるが、動力損失が大きくなり過ぎるのに対し、高圧圧縮吸入圧縮部２４では圧縮する圧力が１０ＭＰａ程と高く、この高圧に打ち勝ってベーン１７をシリンダ室内周面に押圧するには、高めの背圧が必要だからである。

【００４１】そこで、この発明では、中間圧吐出室８の底部に中間圧油貯留室３６、高圧吐出室７の底部に高圧油貯留室３７を設け、中間圧油貯留室３６の潤滑油が低圧吸入圧縮部２３を通過中のベーン１７を押圧するための背圧室１８へ、高圧油貯留室３７の潤滑油が高圧圧縮吸入圧縮部２４を通過中のベーン１７を押圧するための背圧室１８へ供給されるようになっている。

【００４２】すなわち、中間圧油貯留室３６の潤滑油は、フロント油孔３８から軸受部１２へ送られて軸受を潤滑し、フロント絞り孔３９で更に減圧されて両サイドブロック２、３の中間背圧油供給凹部４０へ送られ、この中間背圧油供給凹部４０と接する低圧吸入圧縮部２３通過中の背圧室１８に供給される。一方、高圧油貯留室３７の潤滑油は、リア油孔４１から軸受部１１へ送られて軸受を潤滑し、リア絞り孔４２で更に減圧されて両サイドブロック２、３の高背圧油供給凹部４３へ送られ、この中間背圧油供給凹部４３と接する高圧圧縮吸入圧縮部２４通過中の背圧室１８に供給される。なお、リアサイドブロック２の中間背圧油供給凹部４０への中間背圧油の供給路と、フロントサイドブロック３の高背圧油供給凹部４３への高背圧油の供給路は図示を省略する。

【００４３】中間背圧油供給凹部４０の圧力は、高背圧油供給凹部４３の圧力よりも低く、低圧吸入圧縮部２３を通過中のベーンも、高圧圧縮吸入圧縮部２４を通過中のベーンも、それぞれに適合した背圧が加えられ、過大な動力損失なしで、良好なベーンとシリンダ室とのシールが確保される。

【００４４】なお、背圧室１７から漏れ出す潤滑油は、ロータ９とベーン１７との摺動面、ベーン１７とシリンダ室６との摺動面の潤滑にも使用される。また、中間圧油貯留室３６、高圧油貯留室３７の潤滑油は、図示省略の経路を経てロータ９、ベーン１７と両サイドブロック２、３との摺接面へも送られ、その潤滑にも使用される。潤滑油は、上記油分離器３５で冷媒から分離され、高圧油貯留室３７へ戻される。中間圧油貯留室３６への潤滑油の回収は、中間圧吐出室８に一旦収容される冷媒から分離回収によっている。

【００４５】

【発明の効果】以上詳細に説明したように、この発明の気体圧縮機は、互いに等しい体積の複数の圧縮室が低圧吸入圧縮部と高圧圧縮吸入圧縮部とを順次通過しながら、低圧吸入圧縮部では、低圧の冷媒ガスを低圧吸入孔から吸入して中間圧の冷媒ガスに圧縮して中間圧吐出孔へ吐出し、高圧圧縮吸入圧縮部では、上記の中間圧の冷媒ガスおよび外部から供給される補充用の冷媒ガスを中間圧吸入孔から吸入して高圧の冷媒ガスに圧縮して高圧吐出孔へ吐出するようにしたから、フロン等従来の冷媒を用いたベーンロータリ型気体圧縮機と同様のロータ、ベーン、シリンダを使用でき、簡単でローコスト、小型な気体圧縮機とすることができ、二酸化炭素、エチレン、エタン、酸化窒素等を冷媒とした高い圧力差の気体圧縮機を実現できた。

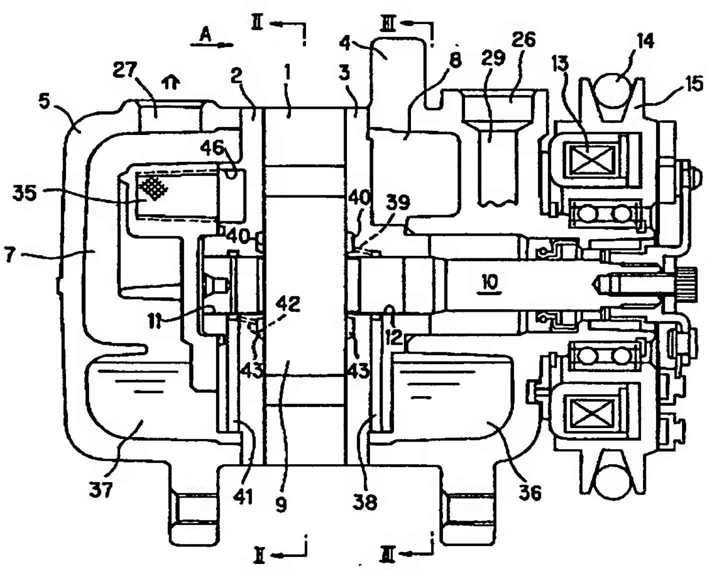
【図面の簡単な説明】

【図１】この発明の一実施の形態を示す縦断面図。

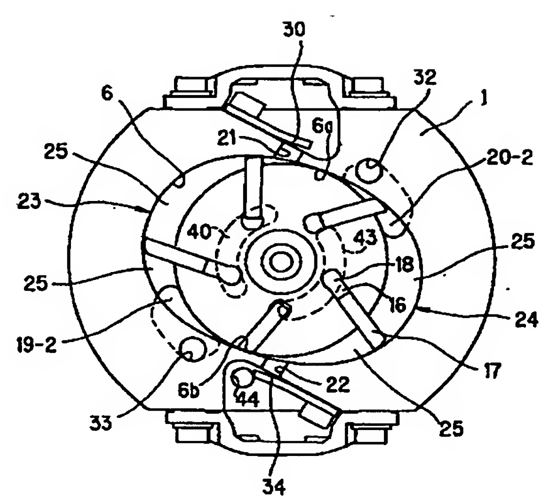
【図２】図１のＩＩ－ＩＩ線断面図。
【図３】図１のＩＩＩ－ＩＩＩ線断面図。
【図４】図１のリアサイドブロックのＡ矢示図。
【図５】図１のフロントサイドブロックのＡ矢示図。
【図６】図１のフロントヘッドのＡ矢示図。
【図７】２段圧縮工程に冷媒を戻す方式の蒸気圧縮式冷凍サイクルの説明図。
【図８】図１の気体圧縮機の２段圧縮行程を示すブロック図。
【図９】図６の蒸気圧縮式冷凍サイクルのモリエル線図。

【符号の説明】
６　シリンダ室
６ａ　短径部
６ｂ　短径部
７　高圧吐出室
８　中間圧吐出室
９　ロータ
１０　ロータ軸
１６　ベーン溝
１７　ベーン
１８　背圧室
１９　低圧吸入孔
１９－２　低圧吸入孔
２０　中間圧吸入孔
２０－２　中間圧吸入孔
２１　中間圧吐出孔
２２　高圧吐出孔
２３　低圧吸入圧縮部
２４　高圧圧縮吸入圧縮部
２５　圧縮室
２６　吸入口
２７　吐出口
２８　外部冷媒ガス供給口
３６　中間圧油貯留室
３７　高圧油貯留室
１００　圧縮機
２００　放熱器
４００　冷却器
６００　蒸発器

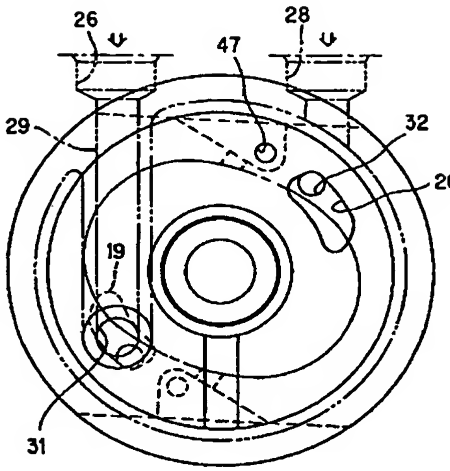
【図１】



【図２】



【図３】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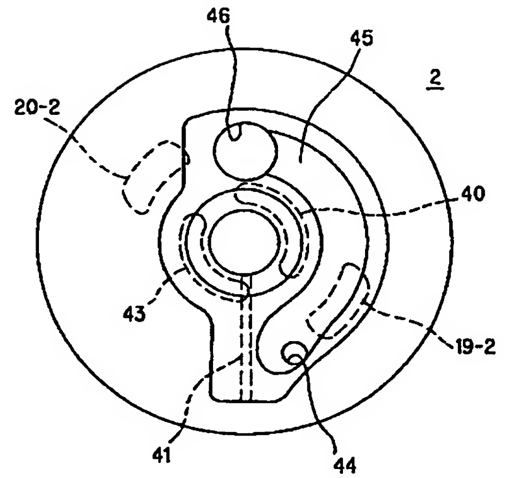
【図４】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20-2
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19-2
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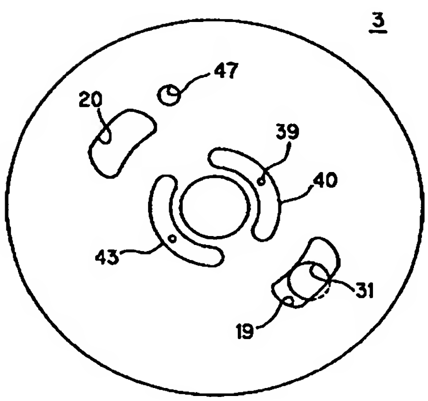
【図５】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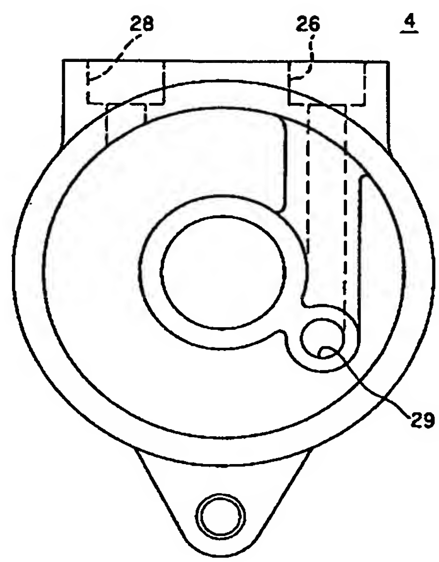
【図６】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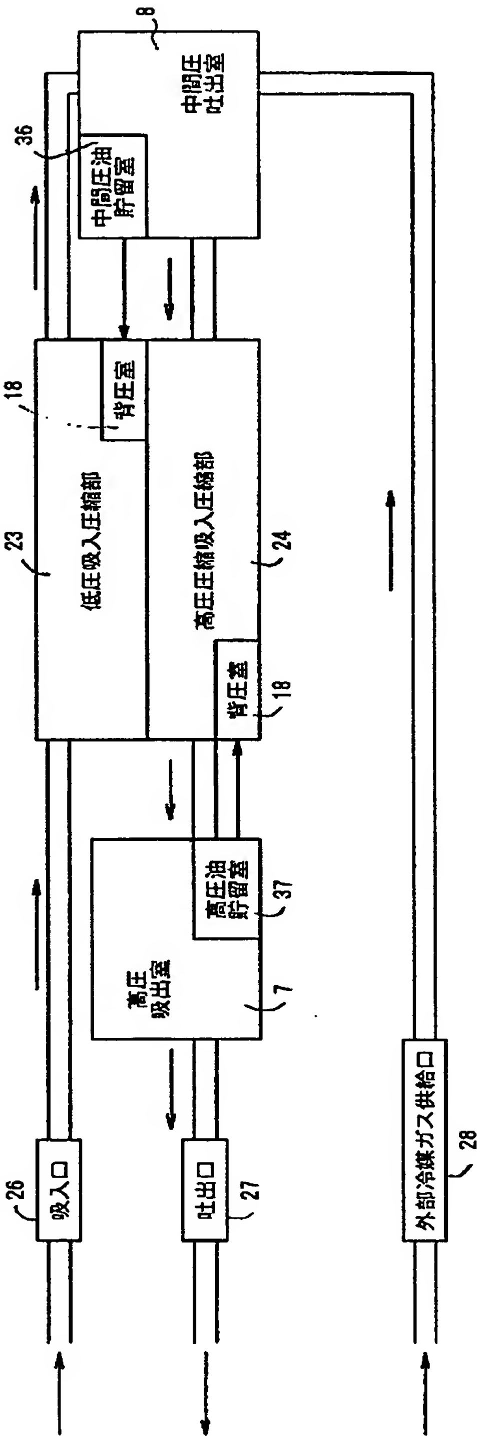
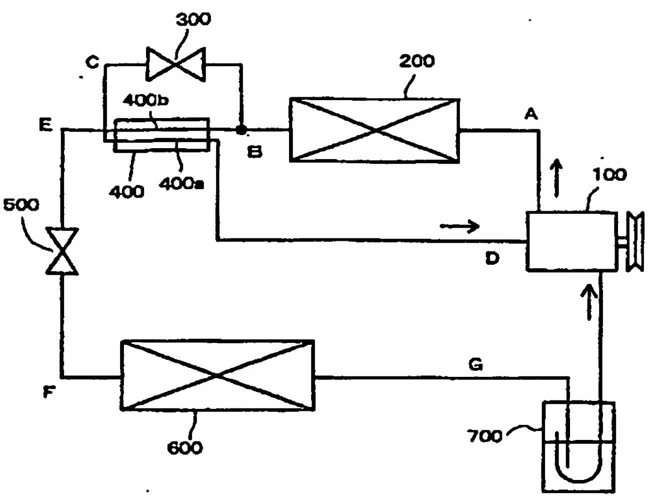
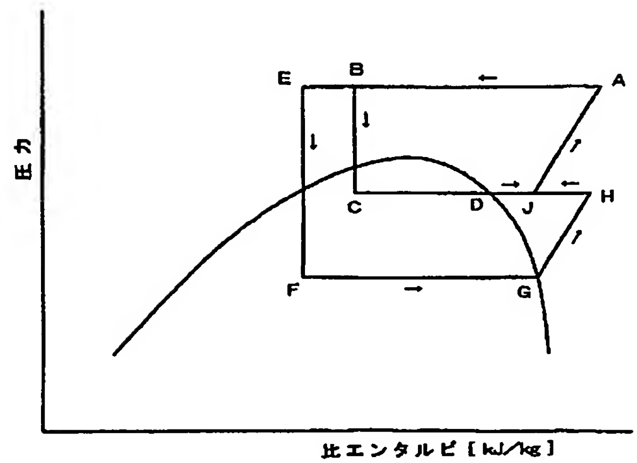
【図７】


8
中間圧
吐出室
36
中間圧油
貯留室
18
背圧室
23
低圧吸入圧縮部
24
高圧圧縮吸入圧縮部
背圧室
18
高圧油
貯留室
37
高圧
吸出室
7
26
吸入口
27
吐出口
28
外部冷媒ガス供給口

【図８】



【図９】



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